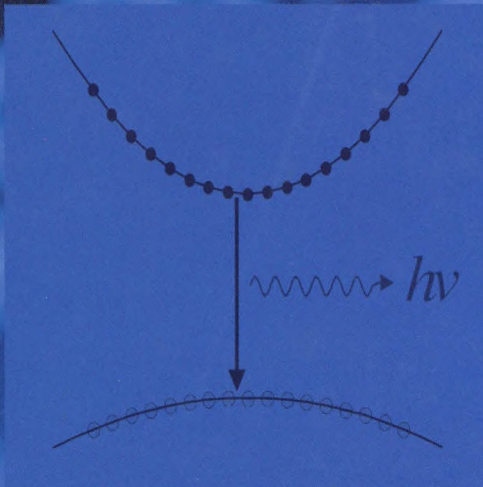


AMNON YARIV
POCHI YEH

PHOTONICS

OPTICAL ELECTRONICS IN
MODERN COMMUNICATIONS



SIXTH EDITION

Photonics

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Contents

Preface xi

Chapter 1 Electromagnetic Fields and Waves 1

- 1.0 Introduction 1
- 1.1 Maxwell's Equations and Boundary Conditions 1
- 1.2 Energy Density and Poynting Vector 4
- 1.3 Monochromatic Fields and Complex-Function Formalism 6
- 1.4 Wave Equations and Monochromatic Plane Waves 8
- 1.5 Chromatic Dispersion and Group Velocity 13
- 1.6 Polarization States and Representations (Stokes Parameters and Poincaré Sphere) 19
- 1.7 Electromagnetic Propagation in Anisotropic Media (Crystals) 30
- 1.8 Plane Waves in Uniaxially Anisotropic Media—Phase Retardation 36
- 1.9 Jones Matrix Method 41
- 1.10 Elementary Theory of Coherence 56
- Problems* 59
- References* 65

Chapter 2 Rays and Optical Beams 66

- 2.0 Introduction 66
- 2.1 Ray Matrices 66
- 2.2 Skew Rays and Reentrant Rays 72
- 2.3 Rays in Lenslike Media 73
- 2.4 Wave Equation in Quadratic Index Media and Beams 77
- 2.5 Gaussian Beams in Homogeneous Media 79
- 2.6 Fundamental Gaussian Beam in a Lenslike Medium—The *ABCD* Law 83
- 2.7 Gaussian Beams in Lens Waveguide 87
- 2.8 High-Order Gaussian Beam Modes in a Homogeneous Medium 88
- 2.9 Gaussian Beam Modes in Quadratic Index Media 91
- 2.10 Propagation in Media with a Quadratic Gain Profile 95
- 2.11 Elliptic Gaussian Beams 97
- 2.12 Beam Propagation and Diffraction Integral 99
- Problems* 106
- References* 109

Chapter 3 Guided Waves in Dielectric Slabs and Fibers 110

- 3.0 Introduction 110
- 3.1 TE and TM Confined Modes in Symmetric Slab Waveguides 110

- 3.2 TE and TM Confined Modes in Asymmetric Slab Waveguides 118
- 3.3 Step-Index Circular Dielectric Waveguides (Linearly Polarized Modes in Optical Fibers) 126
- 3.4 Effective Index Theory 137
- 3.5 Waveguide Dispersion in Optical Fibers 140
- 3.6 Attenuation in Silica Fibers 145
 - Problems* 149
 - References* 153
 - Additional Reading* 155

Chapter 4 Optical Resonators 156

- 4.0 Introduction 156
- 4.1 Fabry–Perot Etalon 160
- 4.2 Fabry–Perot Etalons as Optical Spectrum Analyzers 170
- 4.3 Optical Resonators with Spherical Mirrors 172
- 4.4 Mode Stability Criteria 176
- 4.5 Modes in a Generalized Resonator—Self-Consistent Method 178
- 4.6 Resonance Frequencies of Optical Resonators 180
- 4.7 Losses in Optical Resonators 183
- 4.8 Ring Resonators 184
- 4.9 Multicavity Etalons 194
- 4.10 Mode Matching and Coupling Loss 204
 - Problems* 206
 - References* 209
 - Additional Reading* 210

Chapter 5 Interaction of Radiation and Atomic Systems 211

- 5.0 Introduction 211
- 5.1 Atomic Transitions and Electromagnetic Waves 211
- 5.2 Atomic Polarizability and Dielectric Constant 213
- 5.3 Classical Electron Model 214
- 5.4 Dispersion and Complex Refractive Index 216
- 5.5 Lineshape Function—Homogeneous and Inhomogeneous Broadening 221
- 5.6 Induced Transitions—Absorption and Amplification 225
- 5.7 Gain Saturation in Homogeneous Laser Media 230
- 5.8 Gain Saturation in Inhomogeneous Laser Media 232
 - Problems* 235
 - References* 236

Chapter 6 Theory of Laser Oscillation and Some Specific Laser Systems 237

- 6.0 Introduction 237
- 6.1 Fabry–Perot Laser 237
- 6.2 Oscillation Frequency 242

6.3	Three- and Four-Level Lasers	244
6.4	Power in Laser Oscillators	246
6.5	Optimum Output Coupling in Laser Oscillators	248
6.6	Multimode Laser Oscillation and Mode Locking	251
6.7	Mode Locking in Homogeneously Broadened Laser Systems	265
6.8	Pulse Length Measurement and Narrowing of Chirped Pulses	273
6.9	Giant Pulse (<i>Q</i> -Switched) Lasers	281
6.10	Hole Burning and the Lamb Dip in Doppler-Broadened Gas Lasers	287
6.11	Some Specific Laser Systems	290
6.12	Frequency Comb and Optical Frequency Metrology	303
	<i>Problems</i>	308
	<i>References</i>	309
	<i>Additional Reading</i>	312
Chapter 7 Chromatic Dispersion and Polarization Mode Dispersion in Fibers 313		
7.0	Introduction	313
7.1	Chromatic Dispersion in Optical Transmission Systems	313
7.2	Optical Pulse Spreading in Dispersive Media	317
7.3	Polarization Effects in Optical Fibers	322
7.4	Principal States of Polarization	325
7.5	Vector Analysis of Polarization Mode Dispersion	329
7.6	High-Order PMD and Compensators	346
	<i>Problems</i>	350
	<i>References</i>	353
Chapter 8 Nonlinear Optics 354		
8.0	Introduction	354
8.1	On the Physical Origin of Nonlinear Polarization	354
8.2	Second-Order Nonlinear Phenomena—General Methodology	355
8.3	Electromagnetic Formulation and Optical Second-Harmonic Generation	358
8.4	Other Second-Order Nonlinear Processes	369
8.5	Quasi Phase Matching	377
8.6	Third-Order Nonlinear Optical Processes	380
8.7	Stimulated Brillouin Scattering	387
8.8	Four-Wave Mixing and Phase Conjugation	392
8.9	Frequency Tuning in Parametric Oscillation	399
	<i>Problems</i>	402
	<i>References</i>	404
Chapter 9 Electro-optic Modulation of Laser Beams 406		
9.0	Introduction	406
9.1	Linear Electro-optic Effect	406
9.2	Electro-optic Modulation—Phase, Amplitude	418

- 9.3 High-Frequency Modulation Considerations 427
- 9.4 Electroabsorption and Electroabsorption Modulators 431
- 9.5 Electro-optical Effect in Liquid Crystals 434
- 9.6 Acousto-optic Effect (Photoelastic Effect) 440
- 9.7 Scattering of Light by Sound 446
- 9.8 Bragg Diffraction—Coupled-Wave Analysis 450
- 9.9 Bragg Cells and Beam Deflectors 458
- Problems* 461
- References* 463

Chapter 10 Noise in Optical Detection and Generation 465

- 10.0 Introduction 465
- 10.1 Limitations Due to Noise Power 466
- 10.2 Noise—Basic Definitions and Theorems 469
- 10.3 Spectral Density Function of a Train of Randomly Occurring Events 471
- 10.4 Shot Noise 473
- 10.5 Johnson Noise 475
- 10.6 Spontaneous Emission Noise in Laser Oscillators 479
- 10.7 Phasor Derivation of Laser Linewidth 484
- 10.8 Coherence and Interference 491
- 10.9 Error Probability in a Binary Pulse Code Modulation System 496
- Problems* 499
- References* 500

Chapter 11 Detection of Optical Radiation 501

- 11.0 Introduction 501
- 11.1 Optically Induced Transition Rates 501
- 11.2 Photomultiplier 503
- 11.3 Noise Mechanisms in Photomultipliers 505
- 11.4 Heterodyne Detection with Photomultipliers 507
- 11.5 Photoconductive Detectors 511
- 11.6 The p - n Junction 517
- 11.7 Semiconductor Photodiodes 521
- 11.8 Avalanche Photodiode 529
- 11.9 Power Fluctuation Noise in Lasers 532
- Problems* 536
- References* 537
- Additional Reading* 538

Chapter 12 Wave Propagation in Periodic Media 539

- 12.0 Introduction 539
- 12.1 Periodic Media 539

- 12.2 Periodic Layered Media—Bloch Waves 545
- 12.3 Bragg Reflectors 555
- 12.4 Coupled-Wave Analysis 560
- 12.5 Periodic Waveguides 573
- 12.6 Spectral Filters and Fiber Bragg Gratings 582
- 12.7 Chirped and Tapered Index Gratings 587
- 12.8 2-D and 3-D Periodic Media (Photonic Crystals) 594
- Problems* 600
- References* 601

Chapter 13 Waveguide Coupling 602

- 13.0 Introduction 602
- 13.1 General Properties of Modes 602
- 13.2 Dielectric Perturbation Theory and Mode Coupling 607
- 13.3 Coupling of Two Parallel Waveguides—Directional Coupler 611
- 13.4 Coupling of N Parallel Identical Waveguides—Supermodes 618
- 13.5 Phase Matching and Frequency Selective Coupling—Multiplexing 622
- 13.6 Mode Converters 626
- Problems* 630
- References* 632

Chapter 14 Nonlinear Optical Effects in Fibers 633

- 14.0 Introduction 633
- 14.1 Kerr Effect and Self-Phase Modulation 633
- 14.2 Cross-Phase Modulation—Polarization 637
- 14.3 Nondegenerate Four-Wave Mixing 641
- 14.4 Partially Degenerate Four-Wave Mixing 653
- 14.5 Optical Solitons 663
- Problems* 670
- References* 671

Chapter 15 Semiconductor Lasers—Theory and Applications 673

- 15.0 Introduction 673
- 15.1 Some Semiconductor Physics Background 674
- 15.2 Gain and Absorption in Semiconductor (Laser) Media 680
- 15.3 GaAs/Ga_{1-x}Al_xAs Lasers 686
- 15.4 Some Real Laser Structures 691
- 15.5 Direct-Current Modulation of Semiconductor Lasers 696
- 15.6 Gain Suppression and Frequency Chirp in Current-Modulated Semiconductor Lasers 700
- 15.7 Integrated Optoelectronics 709
- Problems* 711
- References* 712

Chapter 16 Advanced Semiconductor Lasers 714

- 16.0 Introduction 714
- 16.1 Carriers in Quantum Wells (Advanced Topic) 715
- 16.2 Gain in Quantum Well Lasers 720
- 16.3 Distributed Feedback Lasers 724
- 16.4 Vertical Cavity Surface Emitting Semiconductor Lasers 738
- Problems* 746
- References* 746

Chapter 17 Optical Amplifiers 748

- 17.0 Introduction 748
- 17.1 Semiconductor Optical Amplifiers 749
- 17.2 Erbium-Doped Fiber Amplifiers 752
- 17.3 Amplified Spontaneous Emission 755
- 17.4 Optical Amplification in Fiber Links 761
- 17.5 Raman Optical Amplifiers 767
- Problems* 774
- References* 776

Chapter 18 Classical Treatment of Quantum Noise and Squeezed States 778

- 18.0 Introduction 778
- 18.1 The Uncertainty Principle and Quantum Noise 778
- 18.2 Squeezing of Optical Fields 787
- Problems* 795
- References* 796

- Appendix A Wave Equation in Cylindrical Coordinates and Bessel Functions 797
- Appendix B Exact Solutions of the Step-Index Circular Waveguide 802
- Appendix C Kramers–Kronig Relations 812
- Appendix D Transformation of a Coherent Electromagnetic Field by a Thin Lens 817
- Appendix E Fermi Level and Its Temperature Dependence 820
- Appendix F Electro-optic Effect in Cubic $\bar{4}3m$ Crystals 823
- Appendix G Conversion for Power Units and Attenuation Units 827
- Author Index 828
- Subject Index 830

Preface

The field of photonics, sometimes referred to as optical electronics, has continued to evolve vigorously during the last decade, thus justifying a major updating of the last (fifth) edition. The present edition has a broader theoretical underpinning and includes new and important subjects.

The book continues the tradition of introducing basic principles in a systematic self-contained treatment with minimal reliance on outside sources. It describes the physics and methodology of operation of the basic optoelectronic components of importance to optical communications and optical electronics. The book is intended to serve both as a text for students in electrical engineering and applied physics as well as a reference book for engineers and scientists working in those fields.

The present edition reflects two major efforts on our part: (1) the addition of new topics related to technology development in optical electronics and communications (and the omission of some less important topics) and (2) the refinement and improvement of materials already in the fifth edition. In the revision process, we decided to tailor the new edition for students, researchers, and engineers in the area of optical communications who are interested in learning how to generate and manipulate optical radiation and how to put this knowledge to work in analyzing and designing photonic components for the transmission of information. The presentation and inclusion of topics also reflect comments and suggestions from many anonymous reviewers and instructors.

Specifically, the main new features of this edition are:

1. The introduction of Stokes parameters and the Poincaré sphere for the representation of polarization states in birefringent optical networks.
2. The use of Fermat's principle for the derivation of rays, beam propagation, and the Fresnel diffraction integral.
3. The use of matrix methods for treating wave propagation in coupled resonator optical waveguides (CROWs).
4. Matrix treatment of multicavity etalons and multilayer structures.
5. Matrix treatment of mode coupling and supermodes in mode-locked lasers.
6. Chromatic dispersion, polarization mode dispersion (PMD) in fibers, and their compensation.
7. Nonlinear optical effects in fibers: self-phase modulation, cross-phase modulation, stimulated Brillouin scattering (SBS) and stimulated Raman scattering (SRS) in fibers, optical four-wave mixing, and spectral reversal (phase conjugation) in fibers.
8. Electroabsorption and waveguide electro-optic Mach-Zehnder modulators.
9. Periodic layered media, fiber Bragg gratings and photonic crystals, and Bragg reflection waveguides.
10. Optical amplifiers: semiconductor optical amplifiers, erbium-doped fiber amplifiers, and Raman amplifiers.

As in the earlier editions, we assume a basic background in electromagnetic theory and familiarity with Maxwell's equations and electromagnetic wave propagation in the bulk and in waveguides. An elementary acquaintance with quantum mechanics is recommended but may be acquired en route.

A generous use of numerical examples is intended to help bridge the gap between theory and applications.

The authors thank their students and colleagues as well as the many reviewers and lecturers whose comments constituted an important factor in the revision.

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